MADROÑO

A WEST AMERICAN JOURNAL OF BOTANY

VOLUME 16, NUMBER 3 JULY, 1961

Contents

PUBLISHED QUARTERLY BY THE CALIFORNIA BOTANICAL SOCIETY

MADROÑO

A WEST AMERICAN JOURNAL OF BOTANY

Entered as second-class matter at the post office at Berkeley, California, January 29, 1954, under the Act of Congress of March 3, 1879. Established 1916. Subscription price $6.00 per year. Published quarterly and issued from the office of Madroño, Herbarium, Life Sciences Building, University of California, Berkeley 4, California.

THE GENUS LEPIDIUM IN CANADA[1]

GERALD A. MULLIGAN

A world monograph of the genus *Lepidium* was published by Thellung (1906) and a further study of the genus by Hitchcock (1936). According to Hitchcock, Thellung did not have enough North American material at his disposal for an accurate interpretation of our plants. This prompted Hitchcock's comprehensive treatment of the genus *Lepidium* in the United States. However, Hitchcock did not see any material from Canadian herbaria and relatively few Canadian specimens were represented in his material from United States herbaria. Consequently it was not surprising to find on studying Canadian specimens that some of the taxa present in Canada are not included in even the most recent floras or lists. Apparently as the result of not having many Canadian specimens for study, Hitchcock included *L. bourgeauanum*, a common plant in the Canadian prairies, under *L. ramosissimum*. He erroneously applied Thellung's name, *L. bourgeauanum*, to another plant, *L. densiflorum* var. *bourgeauanum*. Specimens of *L. heterophyllum*, a species introduced from Europe, and previously unreported for North America, were found in the material studied.

This paper includes keys to all the *Lepidium* present in Canada and a description and discussion of each taxon. The life durations given are mostly based on information obtained by growing plants in nursery plots at Ottawa. The chromosome numbers given for Canadian material were determined from somatic root tip cells. The root tips studied were processed as in Mulligan (1959). Distribution maps (figs. 12 and 13) were prepared by mapping all the herbarium specimens seen, except where localities were closely duplicated.

A total of 935 herbarium specimens, exclusive of duplicates, was examined from the following Canadian herbaria: Department of Agriculture, Ottawa (DAO); National Museum of Canada, Ottawa (CAN); British Columbia Provincial Museum, Victoria (V); University of British Columbia, Vancouver (UBC). Type specimens were obtained from the Gray Herbarium, Harvard University, Cambridge (GH), the New York Botanic Garden, New York (NY); also seen were McCabe's British Columbia collections from the University of California, Berkeley (UC). I wish to express my appreciation to the curators of these herbaria for the loan of material. I am also indebted to workers at the Plant Research Institute, Canada Department of Agriculture, Ottawa, for their encouragement and assistance in this study.

LEPIDIUM L., Sp. Pl., 643. 1753; Gen. Pl. 291. 1754.

Annual to perennial herbs, glabrous to hirsute with simple hairs.

[1] Contribution 79 from the Plant Research Institute, Research Branch, Canada Department of Agriculture, Ottawa, Ontario.

MADROÑO, Vol. 16, No. 3, pp. 77–108. July 12, 1961.

Flowers small, white to sulfur yellow in dense terminal racemes. Sepals usually somewhat pubescent along back. Petals lacking, or to twice length of sepals. Stamens 2, 4 or 6. Ovary with 2 ovules, style short, stigma capitate, sometimes 2 lobed. Fruit a dehiscent silicle, strongly keeled or winged (silicle indehiscent, not keeled or winged in closely related *Cardaria*). Usually one seed attached to the apex of each cell.

KEY TO THE SPECIES OF LEPIDIUM IN CANADA

a. Middle and upper leaves suborbicular, deeply cordate clasping with a closed sinus and slightly overlapping lobes, thus appearing as if perfoliate . 1. *L. perfoliatum*

aa. Middle and upper leaves narrower, linear to broadly lanceolate, if clasping, not appearing as if perfoliate.

b. Silicles 5 to 6 mm. long.

c. Middle and upper leaves clasping the stem, silicles on spreading pedicels.

d. Annual or biennial with usually a single erect stem; anthers yellow; silicles covered with small white vesicles, style included to slightly exserted from shallow apical notch. . . . . 2. *L. campestre*

dd. Perennial with numerous ascending stems; anthers violet; silicles with few or no vesicles, style mostly exserted from shallow apical notch. 3. *L. heterophyllum*

cc. Middle and upper leaves not clasping, silicles on strongly ascending to appressed pedicels . . . . . 4. *L. sativum*

bb. Silicles 2 to 3.5 mm. long.

e. Glaucous perennial 50 to 130 cm. high, with rhizomes; leaves thickish and rugose, lanceolate to broadly lanceolate . . . . . 5. *L. latifolium*

ee. Annual or biennial, 5 to 40 cm. high, leaves not thickish and rugose, linear to lanceolate.

f. Silicle bidentate at apex, the sinus well developed and broad, its projecting shoulders abruptly contracted into widely divergent teeth, pedicels sigmoid. . . . . 7. *L. oxycarpum*

ff. Silicles merely retuse or acuminate at apex with a shallow sinus, narrowed to abruptly curved into apical teeth; pedicels straight to arching.

g. Silicles puberulent, at least on margin.

h. Silicles 2.5 to 3 by 1.5 to 2 mm., nearly elliptic, narrowed into acute apical teeth; inflorescence congested into numerous axillary racemes as well as terminal ones. . . . . 11. *L. ramosissimum*

hh. Silicles 3 to 3.5 by 2.5 to 3 mm., round-obcordate to short oblong-obovate, rounded to abruptly curved into obtuse apical teeth; inflorescence a single raceme or of sparsely branched racemes 9. *L. densiflorum*

gg. Silicles glabrous.

i. Silicles oval, orbicular to rotund; petals conspicuous, as long or slightly longer than sepals . . . . . 8. *L. virginicum*

ii. Silicles ovate, obovate to round obcordate, petals shorter than sepals or lacking.

j. Silicles ovate to obovate, narrowed into acutish apical teeth.

k. Middle and upper cauline leaves blunt tipped, lower cauline and rosette leaves bipinnatifid, petals absent . . 6. *L. ruderale*

kk. Middle and upper cauline leaves acute tipped, lower cauline and rosette leaves incised, petals present, usually about half length of sepals . . . . . 10. *L. bourgeauanum*

jj. Silicles round obcordate to short-obovate, rounded to abruptly curved into obtuse apical teeth . . . . 9. *L. densiflorum*

1. LEPIDIUM PERFOLIATUM L., Sp. Pl., 643. 1753.

Annual or winter annual with single erect stem 1–5 dm. high, sparsely hairy, usually branched above; lower leaves bipinnate, the middle and upper leaves suborbicular, deeply cordate clasping; petals pale yellow, a little longer than the sepals; stamens usually 6; silicles usually glabrous, rhombic-ovate, on spreading-ascending pedicels, nearly as broad as long, 3–4 mm. long and 3–4 mm. broad; pedicels terete; style usually projecting beyond the shallow apical notch. 2n = 16 (voucher: grown at Ottawa from seed collected at Lethbridge, Alberta, *Mulligan 1527*, DAO, fig. 1).

Rare along roadsides and in waste places in Ontario, Saskatchewan and Alberta. Occasional along roadsides in the Okanagan Valley of British Columbia and rare elsewhere in the Province (fig. 12). This plant, introduced from Eurasia, was first collected in Canada at Cranbrook, British Columbia, in 1931.

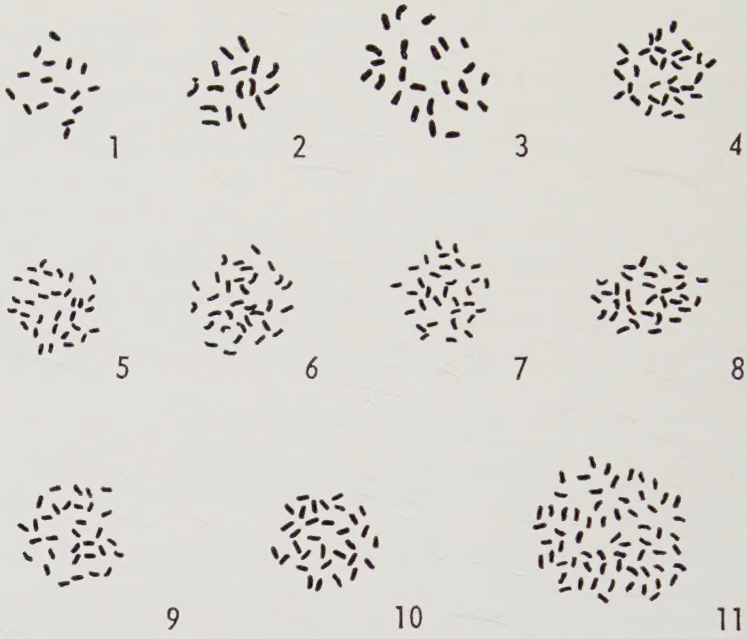
Representative material seen. ONTARIO: York County, at county line of Ontario County, *Shumovich 976* (DAO). SASKATCHEWAN: Swift Current, *Budd* in 1937 (DAO). ALBERTA: Lethbridge, *Bibbey 12* (DAO). BRITISH COLUMBIA: Cranbrook, *Groh* in 1931 (CAN); Kelowna, *McCalla 11598* (UBC, V); Osoyoos, *Lindsay & Woodbury 1128* (DAO).

2. LEPIDIUM CAMPESTRE (L.) R. Br., Ait. Hort. Kew, ed. 2,4:88. 1812.

Annual to biennial with dense short spreading hairs throughout, stem usually solitary, erect, 2–6 dm. high, branched above the middle, the branches ascending; lower leaves entire or lyrate, narrowed into a short petiole, the middle and upper leaves narrowly triangular, sessile, clasping the stem with long narrow pointed basal lobes; petals white, a little longer than sepals; stamens 6 with yellow anthers; pedicels spreading, slightly flattened; silicles densely covered with small white vesicles that become scale-like when dry, silicles oblong-ovate, 5–6 mm. long and 4 mm. broad; style included to slightly exserted from the shallow apical notch. 2n = 16 (voucher: grown at Ottawa from seed collected in southwestern Ontario, *Mulligan 1499*, DAO, fig. 2).

Common in fields, roadsides and waste places in southern Ontario, Quebec and British Columbia. Sporadic along roadsides and in waste places in Newfoundland, Prince Edward Island, Nova Scotia, New Brunswick and Alberta (fig. 12). Introduced from Eurasia.

Representative material seen. NEWFOUNDLAND: Gander, *Bassett 383* (DAO). PRINCE EDWARD ISLAND: Souris, Kings County, *Erskine* and *Smith 2046* (DAO); Charlottetown, *Dore & Gorham* 45.314 (DAO). NOVA SCOTIA: South Sydney, Cape Breton, *Macoun* in 1886 (CAN); Kentville, *Lewis* in 1944 (DAO); Mabou, *Smith et al 8669* (DAO). QUEBEC: Grosse-Ile, Comté de Montmagny, *Marie-Victorin et al 40129* (CAN); Mont-Rolland, *Marie-Anselm 14* (DAO); Bristol, *Bassett* and *Mulligan* 1140 (DAO); Montreal, *Bernard* in 1952 (CAN, UBC). ONTARIO: Milton West, *Mulligan* and *Lindsay 818* (DAO); Snelgrove, *White* in 1897 (CAN); St. Thomas, *James 2478* (DAO); Kemptville, *Lindsay* and *Bassett 213* (DAO); Port Arthur, *Garton 2339* (DAO). ALBERTA: between Macleod and Pincher, *McCalla 11070* (DAO). BRITISH COLUMBIA: Chilliwack, *Faris 32* (DAO); Koksilah, V.I., *Tice* in 1937 (UBC, V); Sandspit, Moresby Island, Queen Charlotte Islands, *Calder 21111* (DAO).



FIGS. 1–11. Somatic chromosomes of *Lepidium*, camera lucida drawings, × 2150. 1, *L. perfoliatum*, 2n=16; 2, *L. campestre*, 2n=16; 3, *L. latifolium*, 2n=24; 4, *L. virginicum* (eastern material), 2n=32; 5, *L. virginicum* (western material), 2n=32; 6, *L. densiflorum* var. *densiflorum*, 2n = 32; 7, *L. densiflorum* var. *macrocarpum*, 2n=32; 8, *L. densiflorum* var. *elongatum*, 2n=32; 9, *L. densiflorum* var. *pubicarpum*, 2n=32; 10, *L. bourgeauanum*, 2n=32; 11, *L. ramosissimum*, 2n=64.

3. LEPIDIUM HETEROPHYLLUM (DC.) Benth., Cat. Pl. Pyr. 95. 1826. *L. smithii* Hook., Brit. Fl., ed. 3, 300. 1835.

Perennial herb with short spreading hairs on leaves and stem; stems many, ascending, 1.5–4.5 dm. high, often branched below as well as above the middle, the branches ascending; lower leaves oblanceolate or elliptical, narrowed into a short petiole, the middle and upper leaves narrowly triangular, sessile, clasping the stem with long narrow basal lobes; petals white, a little longer than sepals; stamens 6, anthers violet; pedicels spreading, slightly flattened; silicles with vesicles lacking or few, oblong-ovate, 5–6 mm. long and 4 mm. broad; style mostly exserted from the shallow apical notch. 2n=16, European material (Fl. Brit. Isles, 175. 1952).

Occasional along roadsides, in fields and waste places on Vancouver Island, British Columbia (fig. 12). This plant was first collected near Victoria in 1908. *Lepidium heterophyllum*, introduced from Europe, was first recognized as occurring in North America by Dr. C. Frankton in

1956 when he identified a specimen, collected near Courtenay, British Columbia, as *L. smithii*.

Material seen. BRITISH COLUMBIA. Vancouver Island: vicinity of Victoria, *Macoun*, May 20, 1908 (CAN), June 19, 1908 (CAN); Telegraph Bay, *Copley 6657* (V); Mt. Finlayson, *Copley 6658* (V); Alberni, *Carter 2196* (V); Millstream Road, *Hardy 7558* (V); S. Saanich, *Newcombe 8917* (V); Sooke, *Hardy 22768* (V); Courtenay, *Molyneux 73* (DAO, UBC, V); 2 miles east southeast Langford, *Calder et al 20795* (DAO).

4. Lepidium sativum L., Sp. Pl., 644. 1753.

Annual with a solitary erect stem 2–8 dm. high, glabrous; lower leaves long-stalked, lyrate with toothed obovate lobes, the middle and upper leaves pinnatipartite or bipinnatipartite, occasionally entire and linear; petals white or reddish, up to twice as long as the sepals; stamens 6; silicles glabrous, broadly elliptical or nearly orbicular, 5–6 mm. long and 3–4 mm. broad; pedicels appressed, flattened; style not projecting beyond the deep apical notch. 2n=16, European material (Jaretzky 1932).

Rare along roadsides and in waste places in Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario, Saskatchewan, Alberta, British Columbia and Yukon Territory (fig. 12). Introduced from Eurasia as early as 1882 but still only a casual escape from cultivation.

Representative material seen. PRINCE EDWARD ISLAND: 4 miles northwest Charlottetown, *Campbell 150* (DAO). NOVA SCOTIA: Harbourville, Kings County, *Lewis* in 1944 (DAO). NEW BRUNSWICK: St. Quentin, *Groh* in 1937 (DAO). QUEBEC: Ste. Annes des Monts, Gaspé, *Macoun* in 1882 (CAN). ONTARIO: Ottawa, *Scott* in 1890 (DAO, CAN). SASKATCHEWAN: Yorktown, *Macoun* and *Herriot* in 1906 (CAN). ALBERTA: Beaverlodge, *Brooks* in 1930 (DAO). BRITISH COLUMBIA: Victoria, *Newcombe 9259* (V); Nelson, *Eastham 3065* (UBC). YUKON TERRITORY: Dawson, *Macoun* in 1902 (CAN).

5. Lepidium latifolium L. Sp. Pl., 644. 1753.

Perennial herb with subterranean rhizomes, each branch of the rhizome giving rise to a single erect stem 5–13 dm. high, glabrous, much branched above; lower leaves long-petioled, simple and ovate with a toothed margin or pinnately lobed with a large terminal and 2 or more smaller lateral lobes, the lobes all rounded, the middle and upper leaves sessile, ovate or ovate-lanceolate, acute, entire or with distant teeth, the uppermost leaves often bract like and white margined near the apex; petals white, up to twice as long as sepals; stamens 6; silicles glabrous to pubescent, elliptical to orbicular, 2 mm. long and 2 mm. broad; pedicels ascending, terete; style very short with large rounded stigma, apical notch very slight or lacking. 2n = 24 (voucher: grown at Ottawa from seed collected at Lethbridge, Alberta, *Mulligan 2147*, DAO, fig. 3).

This plant, introduced from Eurasia, was first collected in 1934 but has remained localized around Quebec City and Lethbridge, Alberta (fig. 12).

Representative material. QUEBEC: Quebec, *Marie-Anselm* in 1934 (DAO). ALBERTA: Lethbridge, *Moss* in 1940 (CAN).

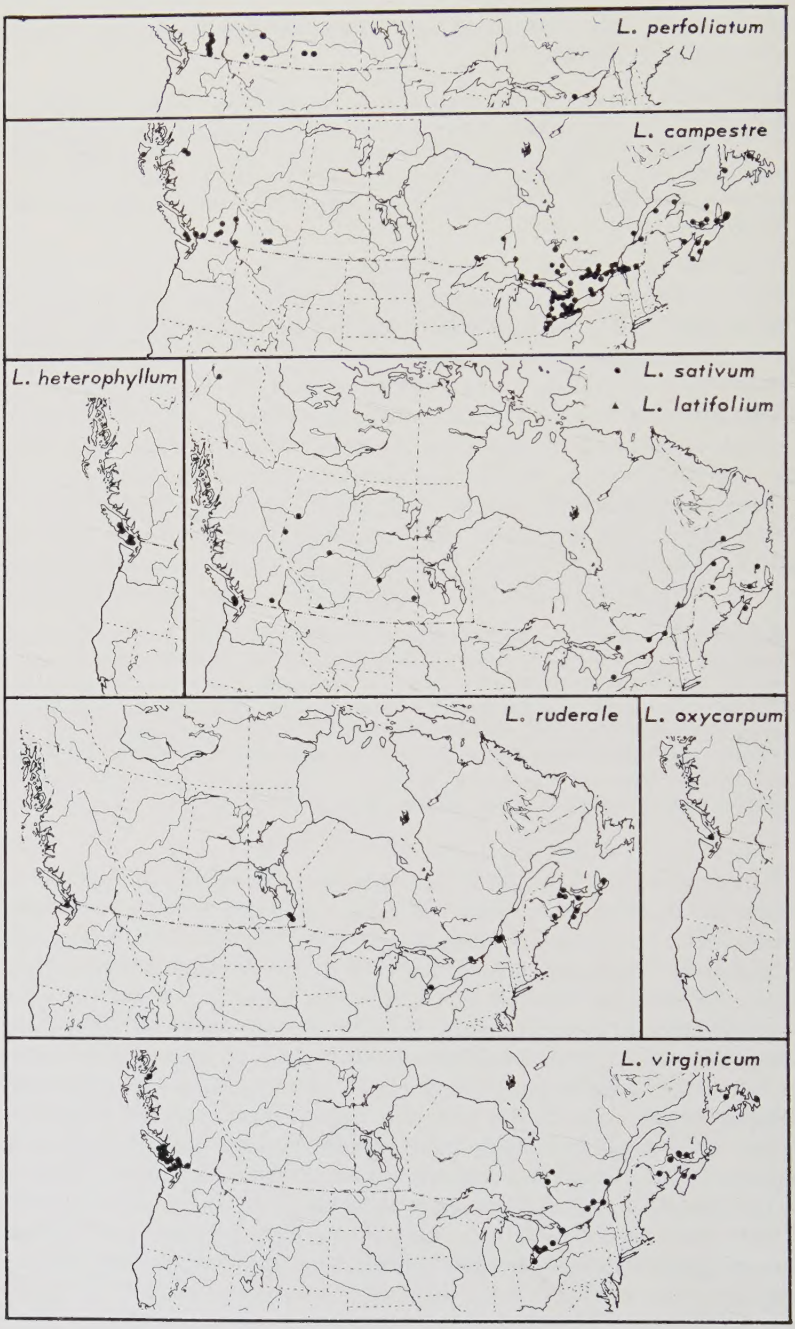


FIG. 12. Distribution maps of *Lepidium*.

6. LEPIDIUM RUDERALE L., Sp. Pl., 643. 1753.

Annual to biennial with single erect or ascending stem 1–3 dm. high, plant almost glabrous, with occasionally a few short spreading hairs; stem branched above, the branches ascending; lower leaves long-petioled, deeply bipinnately divided into narrow entire segments, the middle and upper leaves sessile, narrowly oblong, entire, rounded at apex; petals usually absent; stamens usually 2; silicles glabrous, ovate or broadly elliptical, 2–2.5 mm. long and 1.5–2 mm. broad; pedicels spreading to ascending, slightly flattened; style at base of the shallow apical notch. $2n = 32$, European material (Jaretzky 1932).

Rare along roadsides and in waste places in Nova Scotia, New Brunswick, Quebec, Ontario and Manitoba (fig. 12). Introduced from Eurasia as early as 1868.

Representative material seen. NOVA SCOTIA: North Sydney, *Macoun* in 1883 (CAN). NEW BRUNSWICK: Bass River, Kent County, *Fowler* in 1868 (CAN). QUEBEC: Montreal, *Rolland-Germain 46008* (DAO, CAN). ONTARIO: Wellington, *Montgomery* and *Shumovich 997* (DAO). MANITOBA: Winnipeg, *Frankton* and *Bibbey 60* (DAO).

7. LEPIDIUM OXYCARPUM T. & G., Fl. N. Am. 1:116, 688. 1838.

Slender, nearly glabrous annual, 0.5–2 dm. high, with many semi-erect stems branched above the middle; lower leaves linear, often with 2–4 pairs of linear lobes, middle and upper leaves usually linear and entire; petals white, rudimentary; stamens 4; silicles on slender somewhat sigmoid and flattened pedicels; silicles ovate, glabrous, and finely reticulate, 2.5–3.5 mm. long and 2–2.5 mm. broad, abruptly contracted at apex into a pair of widely divergent teeth; style at base of large apical notch.

The only Canadian specimen of *L. oxycarpum* seen (fig. 12) was collected at Cadboro on Vancouver Island (*Macoun* in 1893, CAN).

8. LEPIDIUM VIRGINICUM L. sensu lat., Sp. Pl., 645. 1753.

Annual, freely branched, erect to spreading, 1.5–6 dm. high, glabrous to strongly pubescent; lower and middle leaves irregularly toothed or incised to pinnatifid, the divisions often again dissected, the upper leaves much reduced, usually entire or remotely toothed; petals white, equalling to much longer than the sepals; stamens usually 2; silicles glabrous, oval, orbicular to rotund, 2.5–4 mm. long and 2.5–4 mm. broad; pedicels spreading to ascending, slightly flattened to terete; stigma included in the shallow apical notch. $2n = 32$ (vouchers: grown at Ottawa from seed collected at St. Thomas, Ontario and Saanichton Spit, British Columbia, *Mulligan 2420* and *2421*, DAO, figs. 4 and 5).

In Canada, *L. virginicum* sensu lat. is represented by eastern and western elements (fig. 12). The positions of the cotyledons in the seeds of Canadian material, as in the United States material (Hitchcock 1936), are accumbent in eastern plants and oblique to incumbent in western plants. Eastern plants occur sporadically in Newfoundland, Prince Edward Island, Nova Scotia, New Brunswick, Quebec and Ontario. These

plants are *L. virginicum* var. *virginicum* and are introduced from further south in the eastern United States. Western plants of *L. virginicum* sensu lat. are found only on Vancouver Island, and the adjacent islands and mainland. They are undoubtedly native to this area. Most of these western plants have morphological characters tending towards the varieties *pubescens* and *medium* as treated by Hitchcock (1936). However, it appears that two and possibly three varieties of *L. virginicum* sensu lat. come together in the southwestern corner of British Columbia and at this northern limit of their range, there is extreme morphological variability in the population. An understanding of the British Columbia plants would require an extensive study of all the western North American material of *L. virginicum* sensu lat. Such a study is outside the limits of this treatment.

Representative material seen. NEWFOUNDLAND: St. John's, *Green 1517* (DAO). PRINCE EDWARD ISLAND: Charlottetown, *Erskine 2332* (DAO). NOVA SCOTIA: Wolfville, *Groh* in 1932 (DAO). NEW BRUNSWICK: Fredericton, *Dore* and *Gorham 45165* (DAO). QUEBEC: Shawinigan Falls, *Groh* in 1927 (DAO, CAN). ONTARIO: near St. Thomas, *Macoun* in 1907 (CAN). BRITISH COLUMBIA: Saanich Spit, *Eastham* in 1939 (DAO, UBC); Parksville, Vancouver Island, *Carter 2195* (V); Jessie Island, Departure Bay, *Macoun* in 1908 (CAN); Mitlenatch Island, *Sweeney 15567* (V).

9. LEPIDIUM DENSIFLORUM Schrad. sensu lat., Ind. Sem. h. Götting. 4. 1832.

Annual to biennial, puberulent to pubescent; stem erect, 1–5 dm. high, usually branched above the middle, sometimes simple; lower leaves mostly oblanceolate, coarsely toothed to pinnatipartite, the divisions also toothed, the middle and upper cauline leaves reduced, slightly toothed or entire; petals white, rudimentary to sometimes equalling the sepals in western varieties; stamens 2; silicles glabrous to puberulent in some of western varieties, round-obcordate to short oblong-obovate, rounded to abruptly curved into obtuse apical teeth, 2–3.5 mm. long and 1.5 to 3 mm. broad; pedicels slightly ascending to nearly appressed, slightly to conspicuously flattened; stigma included in the narrow apical notch.

KEY TO VARIETIES OF L. DENSIFLORUM

a. Silicles averaging 2.5 mm. long, glabrous; pedicels slightly flattened, crowded, more than 9 pedicels per cm. . . . . 9a. var. *densiflorum*
aa. Silicles averaging 3–3.5 mm. long, puberulent except in var. *macrocarpum*; pedicels conspicuously flattened, less crowded, usually less than 9 pedicels per cm.
b. Silicles glabrous . . . . . 9b. var. *macrocarpum*
bb. Silicles puberulent.
c. Silicles puberulent only on margins . . . . . 9c. var. *elongatum*
cc. Silicles uniformly puberulent . . . . . 9d. var. *pubicarpum*

9a. L. DENSIFLORUM Schrad. var. DENSIFLORUM. *L. densiflorum* var. *typicum* Thell., Bull Herb. Boiss., ser. 2, 4:706. 1904.

Plant erect, 1–5 dm. high, annual or winter annual with glabrous silicles, averaging 2.5 mm. long and 2 mm. broad, smaller than all western

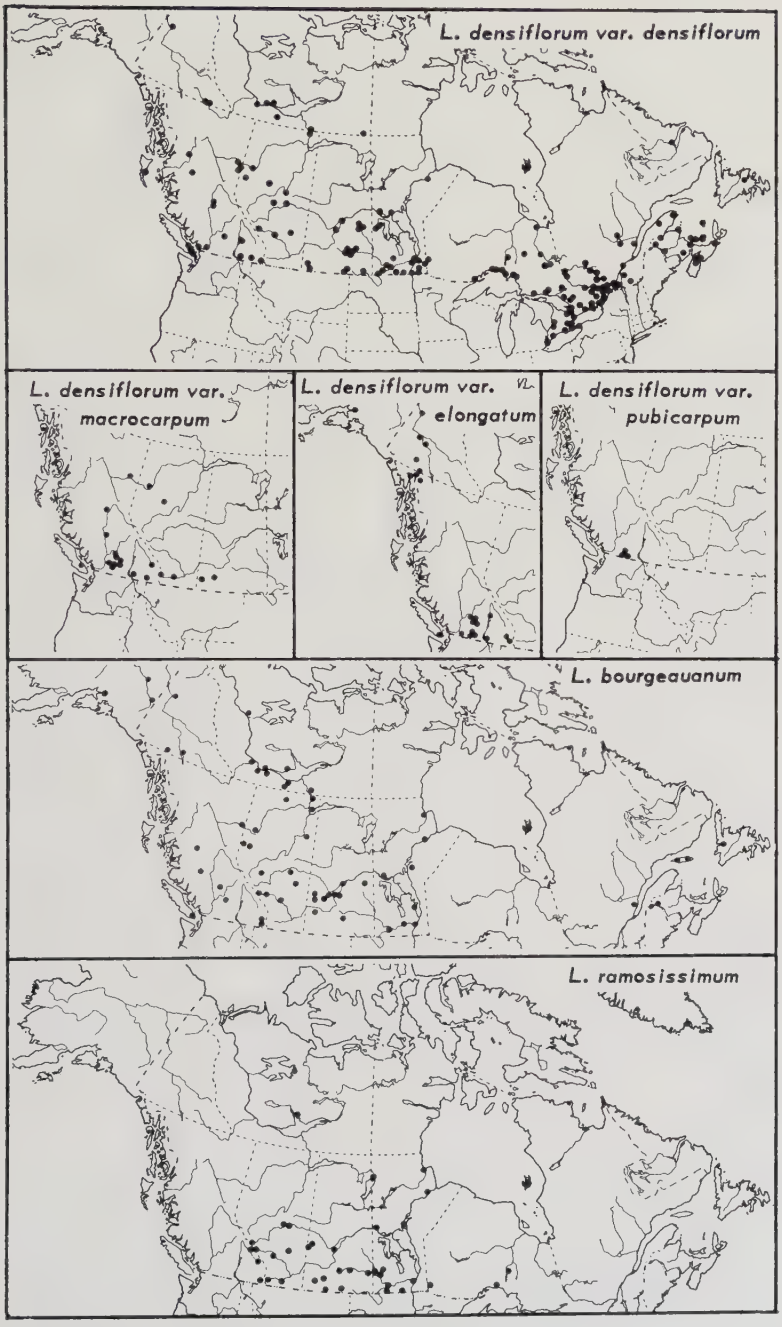


FIG. 13. Distribution maps of *Lepidium*.

varieties. 2n = 32 (voucher: grown at Ottawa from seed collected at Ottawa, *Mulligan 1528*, DAO, fig. 6).

Widely distributed in all types of disturbed habitats: Newfoundland, Prince Edward Island, Nova Scotia, New Brunswick, Labrador, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia, Yukon Territory and Mackenzie District, Northwest Territories (fig. 13). Native to the Prairie Provinces, interior of British Columbia and probably some localities in eastern Canada. Weedy throughout its range.

Representative material seen. NEWFOUNDLAND: Gander, *Bassett 462* (DAO). PRINCE EDWARD ISLAND: Bideford, Prince County, *Smith 319* (DAO); French River, *Fernald et al 7508* (CAN). NOVA SCOTIA: Boylston, *Hamilton* in 1890 (CAN); Wolfville, *Groh* in 1928 (DAO). NEW BRUNSWICK: Point du Chene, *Bassett* and *Mulligan 2964* (DAO); Woodstock, *Macoun* in 1899 (CAN); Edmunston, *Malte 332* (CAN). LABRADOR: Goose Bay, *Gillett* and *Findley 5883* (DAO, UBC). QUEBEC: Nominique, *Lucien* in 1924 (CAN); Magog, *Bassett* and *Hamel 2322* (DAO); Shawville, *Mulligan* and *Lindsay 382* (DAO); Ville Marie, *Baldwin 5940* (CAN). ONTARIO: Leamington, *Macoun* in 1901 (CAN); Moosonee, *Baldwin 1453* (CAN); Goderich, *Senn et al 4759* (DAO); Point Pelee, *Bassett 1112* (DAO). MANITOBA: Douglas, *Lindsay 490* (DAO); Duck Mountain, *Scoggan* and *Baldwin 7793* (CAN); Fort Ellice, *Macoun* in 1879 (CAN); The Pas, *Krivda 1223* (DAO). SASKATCHEWAN: Dundurn, *Campbell 54* (DAO); Prince Albert, *Macoun* in 1876 (CAN); Cypress Hills, *Breitung 5001* (DAO); Bjorkdale, *Van Blaricom* in 1941 (DAO). ALBERTA, 7 miles north Fort Fitzgerald, *Cody* and *Loan 3863* (DAO); 20 miles west Selba, *McCalla 12313* (UBC); Fort Saskatchewan, *Turner 4873* (CAN). BRITISH COLUMBIA: 141 Mile House, *Cottle* in 1949 (UBC); Grand Forks, *Tice* in 1933 (V); Yahk, *Bassett* and *Cumming 3970* (DAO). NORTHWEST TERRITORIES: Fort Simpson, *Cody* and *Matte 8109* (DAO); Alexander Falls, Hay River, *Lewis 558* (DAO). YUKON TERRITORY: Watson Lake, *Gillett 2585* (DAO).

9b. L. DENSIFLORUM Schrad. var. **macrocarpum** var. nov. *L. densiflorum* var. *bourgeauanum* sensu Hitchcock, Madroño, 3:279, 1936, nec L. *bourgeauanum* Thellung.

Herba biennis erecta, saepius 1–3 dm., siliculis glabris, 3.0–3.5 mm. long., 2.5–3.0 mm. lat., 2n = 32 ex canadensibus.

Plant erect, 1–3 dm. high, biennial with glabrous silicles 3.0–3.5 mm. long and 2.5–3.0 mm. broad. 2n = 32 (voucher: grown from seed collected at Cache Creek, *Mulligan 2416*, DAO, fig. 7).

Native on dry open soil in western Saskatchewan, Alberta and British Columbia, as far north as Prince George, British Columbia (fig. 13).

Type. Lethbridge, Alberta, Platières de la rivière Sainte-Marie près de son embouchure, 23 juin 1958, *Boivin, Perron* and *Harper 12197* (DAO), fig. 14.

Material seen. SASKATCHEWAN: Webb, 7 miles au nord, *Boivin et al 12005* (DAO); Saskatchewan Landing, *Russell S58099* (DAO); 7 miles au sud de la Station Expérimentale de Manyberries, *Boivin* and *Alex 9651* (DAO). ALBERTA: 1 mile east of Canmore, south of Peace River, *Macoun* in 1903 (CAN); Canyon Creek, *Boivin* and *Perron 12744* (DAO); Lethbridge, *Boivin* and *Perron 12166* (DAO). BRITISH COLUMBIA: Tranquille, *Groh 246* (DAO); Lillooet, *Luyat* in 1928 (V), *Anderson 2197* (V), *Macoun* in 1916 (CAN); Kamloops, *Davidson* in 1912 (UBC), *Tisdale 40–410* (DAO), *Wattie* in 1915 (UBC); Kamloops, Thompson

River Flats, *Brink* in 1935 (UBC), a mixture of 1 plant var. *macrocarpum* and 2 plants var. *elongatum;* Spences Bridge, *Macoun* in 1899 (CAN); Hamilton Commonage, Nicola Valley, *Tisdale* in 1935 (DAO), *40-409* (DAO); Cache Creek, *Mulligan* and *Woodbury 1617* (DAO); Hat Creek Valley, *Thompson* and *Thompson 221* (DAO); Yahk, *Bassett* and *Cumming 3988* (DAO); Cecil Lake, *Merten* in 1958 (DAO); Riley's Ranch, Big Bear Creek, *Copley 6430* (V); Fairmont, *Anderson 225* (V); Merritt, *Copley 7312* (V); Nelson, *Eastham 3057* (UBC); Macalister, *Taylor* and *Lewis 286* (UBC); Prince George, *Eastham 14735* (UBC); Nanaimo, *Eastham 3058* (UBC); Lytton, *Dawson* in 1876 (CAN); Crow Nest Pass, *Macoun* in 1897 (CAN); 2½ miles south Merritt, *McCabe 4523* (UC); 21½ miles south Williams Lake, *McCabe 1312* (UC).

9c. L. DENSIFLORUM Schrad. var. ELONGATUM (Rybd.) Thell., Bull. Herb. Boiss., Ser. 2, 4:706. 1904; Monog. Lepid. 235. 1906. *L. elongatum* Rydb., Bull. Torr. Bot. Club, 29:234. 1902. *L. simile* Heller, Bull. Torr. Bot. Club, 26:312. 1899.

Plant erect, 1–3 dm. high (rarely taller), biennial with silicles puberulent only on margins, 3–3.5 mm. long and 2.5–3 mm. broad. $2n = 32$ (voucher: grown at Ottawa from seed collected at Ashnola River, Flat-iron Mountain, British Columbia, *Mulligan 2422*, DAO, fig. 8).

Native on dry open soil in interior of British Columbia and as far north as Kamloops. Apparently also native along the Mackenzie River in Yukon Territory and in the northwestern corner of British Columbia (fig. 13).

Representative material seen. BRITISH COLUMBIA: 1 mile east Fort Steele, *Calder* and *Savile 9149A* (DAO); Fernie, *Bassett* and *Cumming 3986* (DAO); Goodfellow Creek, *Hardy 18.875* (V); Revelstoke, *Macoun* in 1890 (CAN); Windy-Arm, Yukon Boundary, *Gervaise* in 1914 (UBC); 2 miles north Skookumchuck, *McCabe 5031* (UC). YUKON TERRITORY: Carcross, *Gillett 3384* (DAO); Whitehorse, *Gillett 3508* (DAO); island in Klondike River, *Macoun* in 1902 (CAN).

9d. L. DENSIFLORUM Schrad. var. PUBICARPUM (Nelson) Thell., Bull. Herb., Boiss., Ser. 2, 4:706. 1904; Monog. Lepid., 235. 1906. *L. pubicarpum* Nelson, Bot. Gaz. 30:189. 1900.

Plant erect, 1–3 dm. high (rarely taller), annual or winter annual with puberulence scattered over all of silicle, 3–3.5 mm. long and 2.5–3 mm. broad. $2n = 32$ (voucher: grown at Ottawa from seed collected at Osoyoos, British Columbia, *Mulligan 2412*, DAO, fig. 9).

Known to occur in Canada only around Osoyoos and Penticton, British Columbia (fig. 13).

Material seen. BRITISH COLUMBIA: 19 miles east Osoyoos, *Mulligan* and *Woodbury 2010* (DAO); Osoyoos, *Lindsay* and *Woodbury 630* (DAO); Penticton, *Eastham 3056* (UBC), *7067* (UBC); Okanagan Valley at U.S. Boundary, *McCabe 5848* (UC).

10. LEPIDIUM BOURGEAUANUM Thell., Monog. Lepid., 237, 1906. *L. fletcheri* Rydb., Bull. Torr. Bot. Club, 34:428. 1907.

Biennial, 1.5–6 dm. high, sparsely to densely puberulent throughout; stem erect, with many ascending to nearly appressed branches bearing usually less than 5, rarely up to 10 racemes; lower leaves incised, middle

FIG. 14. *Lepidium densiflorum* var. *macrocarpum*, holotype, *Boivin, Perron* and *Harper 12197* (DAO), left; *Lepidium bourgeauanum*, a representative specimen, *Calder* and *Billard 4627* (DAO), right.

leaves incised or sometimes slightly toothed; upper leaves linear, entire, rarely slightly toothed; petals white, up to ¾ length of the sepals; stamens 2; silicles glabrous, ovate to obovate, 2.5–3 mm. long, and 1.5–2 mm. broad; pedicels spreading to ascending, slightly flattened; style included in the apical notch. $2n = 32$ (vouchers: grown at Ottawa from seed collected at St. Simeon, Province Quebec, Alexander Falls and Norman Wells, Mackenzie District, *Mulligan 2423*, *2418* and *2419*, DAO, fig. 10).

Fairly common on open soil in Manitoba, Saskatchewan, Alberta, British Columbia, Yukon Territory and Northwest Territories, and probably native in all these areas. It also occurs at a few locations in Newfoundland, New Brunswick, Ontario and Quebec, where it has probably been introduced (fig. 13).

Lepidium bourgeauanum, described by Thellung (1906), was based on a collection of Bourgeau [Saskatchewan, 1857–8, Bourgeau (Pallisers Brit. N. Am. Exped.)—Herb. Petersburg]. Hitchcock (1936) applied this name to his *L. densiflorum* var. *bourgeauanum*, a plant that is relatively rare on the Canadian prairie. However, Thellung's description obviously refers to the plant here being treated (see fig. 14), not Hitchcock's *L. densiflorum* var. *bourgeauanum*. A Bourgeau specimen [labelled Lake Winnipeg Valley, 1857 (Pallisers Brit. N. Am. Exped.)] in the Gray Herbarium, Harvard University, is *L. bourgeauanum*. This specimen is possibly an isotype of *L. bourgeauanum* with more complete label data than the holotype in the Petersburg Herbarium. *L. bourgeauanum* has been included under *L. ramosissimum* by most botanists, but in addition to the differences in morphology and geographic distribution, the former plant has 32 somatic chromosomes while the latter plant has 64.

Representative material seen. NEWFOUNDLAND: Deer Lake, *Rouleau 1160* (DAO). NEW BRUNSWICK: 2 miles north northeast Edmunston, Madawaska County, along railroad tracks, *Mulligan* and *Spicer 2538* (DAO), not mapped on fig. 13. ONTARIO: Prescott, Grenville County, single plant near grain elevator, *Dore 18299* (DAO), not mapped on fig. 13. QUEBEC: 2 miles west St. Simeon, *Bassett* and *Hamel 2190* (DAO); Ellis Bay, Anticosti Island, *Johansen* in 1923 (CAN). MANITOBA: Lake Winnipeg Valley, *Bourgeau* in 1857 (GH, possibly isotype of *L. bourgeauanum*); Brandon, *Macoun* in 1896 (CAN); Churchill, *Beckett 3852* (DAO); Winnipeg, *Fletcher* in 1905 (DAO, isotype of *L. fletcheri*). SASKATCHEWAN: Cherryfield, *Macoun* and *Herriot 69881* (CAN, paratype of *L. fletcheri*); Dana, *Senn et al 2745* (DAO); 16 miles west Saskatoon, *Macoun* and *Herriot* in 1906 (CAN); Lee's Lake Reservoir, *Bird 1560* (DAO). ALBERTA: Fort McMurray, *Cody* and *Gutteridge* in 1953 (DAO); Beaverlodge, *Jenkins 123* (DAO); Calgary, *Macoun* in 1897 (CAN). BRITISH COLUMBIA: Sinkut Lake, *Eastham 16959* (UBC, V); 54 miles south Williams Lake, *Mulligan* and *Woodbury 1776* (DAO). NORTHWEST TERRITORIES. Mackenzie District: Wrigley Harbour, Brabant Island, *Lewis 998* (DAO); 2 miles east Trout River, *Cody* and *Matte 8637* (DAO); Indian Village on north shore of Mackenzie River, *Cody* and *Matte 8622* (DAO). YUKON TERRITORY: West Dawson, *Calder* and *Billard 4627* (DAO).

11. Lepidium ramosissimum Nelson, Bull. Torr. Bot. Club, 26:124, 1899. *L. ramosissimum* var. *robustum* Thell., Monog. Lepid., 236. 1906.

Biennial, 1–4 dm. high, sparsely to densely puberulent; stem erect, usually profusely branched throughout, with many spreading to ascending branches bearing usually more than 10, occasionally as few as 5 racemes; lower and middle leaves sessile, pinnately or bipinnately parted; upper cauline leaves usually with at least one pair of linear lobes towards the apex, rarely entire; petals white, up to ¾ length of the sepals; stamens 2; silicles puberulent, at least along margins, ovate to obovate, 2.5–3 mm. long and 1.5–2 mm. broad; pedicels spreading to ascending, slightly flattened; style included in the apical notch. 2n = 64 (vouchers: grown at Ottawa from seed collected at Stirling and Edmonton, Alberta and Yellowknife, Mackenzie District, *Mulligan 2129, 2424* and *2417*, DAO, fig. 11).

Fairly common on open soil in Manitoba, Saskatchewan and Alberta; rare in western Ontario, British Columbia and Mackenzie District, Northwest Territory. Native in the Prairie Provinces, but possibly introduced elsewhere (fig. 13). The first Canadian collection seen was collected by Bourgeau, at Fort Ellice, Manitoba, in 1857.

Representative material seen. ONTARIO: Schreiber, *Hosie et al 689* (CAN). MANITOBA: Snowflake, *Bassett* and *Kemp 3504* (DAO); Norway House, off north end of Lake Winnipeg, *Scoggan 4233* (CAN); Churchill, *Beckett 3* (DAO); Buttes de Sables au Fort Ellice, *Bourgeau* in 1857 (GH). SASKATCHEWAN: Scott, *Groh* in 1933 (DAO); Twelve-Mile Lake, Wood Mountain, *Macoun* in 1895 (CAN); Saskatchewan, *Bourgeau* in 1858 (GH, isotype of *L. ramosissimum* var. *robustum*); Scott, *Groh* in 1933 (DAO). ALBERTA: Edmonton, *Frankton 895* (DAO); Fort Saskatchewan, *Turner 4948* (DAO, UBC); Craigmyle District, *Brinkman* in 1921 (CAN); Frank, *Bassett* and *Cumming 3975* (DAO). BRITISH COLUMBIA: Windermere Slough, Columbia Valley, *Eastham 16288* (V, UBC); Windermere, *McCabe 6365* (UC); Fernie, *Bassett* and *Cumming 3971* (DAO). NORTHWEST TERRITORIES. Mackenzie District: Yellowknife, *Cody* and *McCanse 3045* (DAO).

Plant Research Institute, Research Branch,
Canada Department of Agriculture, Ottawa, Canada

Literature Cited

Hitchcock, C. L. 1936. The genus Lepidium in the United States. Madroño 3:265–320.

Jaretzky, R. 1932. Beziehungen zwischen Chromosomenzahl und Systematic bei den Cruciferen. Jahrb. wiss. Botan. 76:485–527.

Mulligan, G. A. 1959. Chromosome numbers of Canadian weeds. II. Can. Jour. Bot. 37:81–92.

Thellung, A. 1906. Die Gattung Lepidium (L.) R. Br. Eine monographische Studie. Mitteilungen bot. Mus. Univ. Zürich. 28:1–340.

ESCHSCHOLZIA COVILLEI GREENE, A TETRAPLOID SPECIES FROM THE MOJAVE DESERT[1]

THEODORE MOSQUIN

The purpose of this paper is to establish the validity of *Eschscholzia covillei* Greene (Papaveraceae) as a taxon of specific rank on the basis of a comparative study of morphological variation in relation to chromosome number and geographical distribution. *Eschscholzia covillei* is one of a group of closely related taxa in the deserts of southwestern United States and adjacent Mexico that has frequently been treated as conspecific with *E. minutiflora* Watson (e.g., Jepson, 1922, 1925; Munz, 1935; Abrams, 1944; Munz, 1959).

Lewis and Snow (1951) pointed out that *E. minutiflora* is hexaploid (n=18) and that a diploid species, *E. parishii* Greene (n=6), formerly considered a variety of *E. minutiflora*, is readily distinguishable from the latter on morphological grounds. They also pointed out that plants intermediate between these two taxa in Inyo County, California, might be tetraploid and genetically distinct from both *E. minutiflora* and *E. parishii*. This suggestion was confirmed in 1957 when a collection of the intermediate material from the White Mountains (*Lewis 1084*) was determined to be tetraploid (n=12). More recently Ernst (1959) has reported the tetraploid number of chromosomes for two collections from the same area (*Ernst 561, 564*). From study of my own collections, I have found that these intermediate specimens are consistently tetraploid and morphologically distinguishable from both the diploid, *E. parishii*, and the hexaploid, *E. minutiflora*. Consequently the tetraploid should be recognized as a distinct species. An examination of the literature and of the type specimens concerned indicates that the earliest specific name for the tetraploid is *E. covillei* Greene. This was clearly designated on the United States National Herbarium sheet (number 3340) by Greene.

ESCHSCHOLZIA COVILLEI Greene, Pittonia 5:275. 1905. Type: from Pete's Garden to 1000 feet below, Johnson Cañon, Panamint Mountains, Inyo County, California, elevation 1700 meters, *Coville & Funston 519* (US). *E. minutiflora* var. *darwinensis* M. E. Jones, Contr. West. Bot. 8:2–3, 1898. Type: on mesas, Darwin, Inyo County, California, *Jones* in 1897 (POM).

Glabrous annual herb, to 40 cm. tall, freely branched throughout; basal rosettes well-developed with leaves coarsely divided, numerous,

[1] I am grateful to Dr. Harlan Lewis for suggesting this problem to me and for critical review of the manuscript. Special thanks are due to Dr. Peter H. Raven for his assistance in checking types and for other helpful suggestions. I also wish to thank Dr. Richard Snow for permission to publish his previously unreported chromosome number determinations, and for permission to examine the specimens in their care the curators of the following herbaria: the University of California, Berkeley; Pomona College; Rancho Santa Ana Botanic Garden; and the San Diego Museum of Natural History.

glaucous, 6–13 cm. long, the blade 0.5–4.5 cm. long, 0.5–4 cm. wide; upper leaves strongly reduced; mature buds elliptical, 6–9 mm. long, acuminate; pedicels 1–8 cm. long; torus turbinate; petals obovoid-cuneate, golden-yellow, 7–17 mm. long; stamens 8–15 per flower, 3.5–5 mm. long; pollen with 7–10 grooves (usually 8 or 9), 24–37 microns in diameter; seeds with finely reticulate grey-brown coat; chromosome number, $n = 12$.

Distribution. Slopes and washes of desert mountains, Inyo and San Bernardino counties, California (fig. 1).

Representative specimens. CALIFORNIA. Inyo County: Panamint Valley, 11 miles southwest of Ballarat on road to Ridgecrest, *Mosquin & Lewis 3241* (LA, UC); 0.7 mile from junction to Darwin on road to Darwin Falls, *Mosquin & Lewis 3251* (LA, UC); Panamint Valley, 7.2 miles east of junction to Trona on road to Stovepipe Wells, *Mosquin & Lewis 3255* (LA, UC); Emigrant Canyon, *Mosquin & Lewis 3256, 3257* (LA, UC); 0.6 mile west of Bradbury Well entrance to Death Valley National Monument, *Mosquin & Lewis 3258–1* (UC); Westgard Pass road, *Lewis 1084* (LA); Nelson Range, *Austin* in 1906 (UC); Pleasant Canyon, Panamint Mountains, *Hall & Chandler 6965* (UC); Hole-in-the-Rock Spring, *Epling* et al. in 1930 (LA, UC); Hanaupah Canyon, Panamint Mountains, in 1922 (collector unknown, SD); Shepherds Canyon, Argus Mountains, *Keller 126* (SD); Black Canyon, White Mountains, *Duran 2668* (LA, UC); Bishop Creek, 5,200 feet, *Hall & Chandler 7249* (UC); Darwin, 4,600 feet, *Jones*, April 28, 1897 (POM); from Pete's Garden to 1000 feet below, 1,700 meters, *Coville & Funston 519* (US). San Bernardino County: 7 miles east of Daggett, *Munz & Keck 7843* (POM); 10 miles southwest of Garlic Springs, *Munz & Keck 7878* (POM).

Eschscholzia covillei is usually readily distinguishable from *E. minutiflora* (table 1), especially when the two are found in adjacent or mixed colonies. Where they occur in mixed colonies the two are distinguished by flower size and habit. It is perhaps more difficult to distinguish *E. covillei* from *E. parishii*, but the two are not known to grow together (fig. 1). In general, the latter two differ consistently in stamen number and in the number of grooves on the pollen. The specimens from San Bernardino County that are identified as *E. covillei* are geographically closest to *E. parishii* and it would be desirable to have additional chromosome number determinations from this area in order to confirm their identification. The hexaploid species, *E. minutiflora*, also grows sympatrically with *E. parishii*, and in such localities plants of the two species are readily distinguished, as is also true of most herbarium specimens, by the larger flowers and greater stamen number of *E. parishii*. All three species are found on comparatively moist alluvial slopes and fans, but unlike the other two species, the hexaploid *E. minutiflora* extends onto the desert floor.

Plants of *Eschscholzia parishii* from near Randsburg, Kern County (*Lewis & Mosquin 1117*; *Heller 7683*), the only locality for this species on the Mojave Desert, are intermediate in several morphological traits between *E. parishii* from the Colorado Desert and *E. covillei*. They may have as few as 14 stamens per flower, and they have an intermediate pollen morphology and stamen number. In the Heller collection, pollen

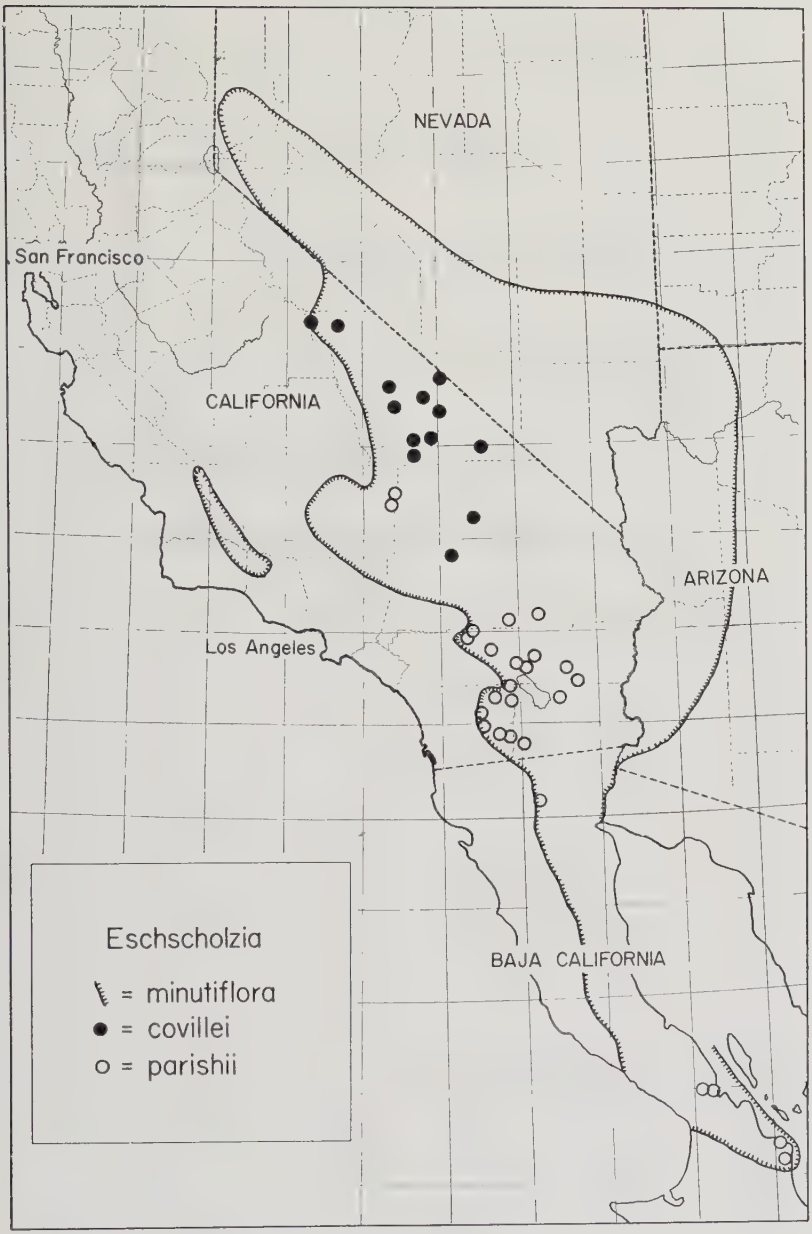


FIG. 1. General distribution of *Eschscholzia minutiflora* and selected localities of *E. covillei* and *E. parishii*.

size varied from 17–21 microns, and the two buds examined had, respectively, 14 and 15 stamens. The pollen had 7 and 8 grooves in approximately equal frequencies. In the Lewis and Mosquin collection, for which the chromosome number has been determined, pollen diameter varied from 20–32 microns, the pollen had 7, rarely 6, grooves per grain, and the stamen number varied from 16–18 per flower. In view of these morphological traits this might be considered a local subspecies of *E. parishii*.

The chromosomes of all three species are similar in size and morphology, with ring bivalents being more frequent than rods. The following list includes all known chromosome counts[2] made in this group:

Eschscholzia parishii (n = 6). California. Kern County: about 2 miles southeast of Searles Station, *Lewis* & *Mosquin 1117* (3 plants, 1 count from somatic cells). Riverside County: Morongo Wash, *Snow 11* (5 plants)[a]; about 5 miles west of road to Cottonwood Springs on United States Highway 60, *Lewis* & *Ernst* in 1949 (3 plants)[b]; Joshua Tree National Monument, *Lewis* in 1949[b]; Box Canyon, *Snow 7*[a]; *Raven 11478* (somatic count).

Eschscholzia covillei (n = 12). California. Inyo County: *Mosquin* & *Lewis 3241* (2 plants), *3251* (3 plants), *3255–3, 3255–4* (2 plants), *3256* (2 plants), *3258–1*; *Lewis 1084*; Westgard Pass road, 2.8 miles west of Zurich, *Ernst 561*[d], 1.6 miles west of Zurich, *Ernst 564*[d].

Eschscholzia minutiflora (n = 18). California. Imperial County: road to 17 Palms, 0.3 miles east of United States Highway 99, *Lewis* in 1952. Inyo County: Panamint Valley, 15 miles north of road to Darwin on road to Stovepipe Wells, *Mosquin* & *Lewis 3240*; 4.6 miles from junction of State Highway 190 with road to Darwin Falls, *Mosquin* & *Lewis 3249, 3250* (total of 3 plants); 4.2 miles north of road to Darwin Falls on road to Darwin Springs, *Mosquin* & *Lewis 3254*; Panamint Valley, 7.2 miles east of junction to Trona on road to Stovepipe Wells, *Mosquin* & *Lewis 3255–1, 3255–2* (2 plants); 0.6 mile west of Bradbury Well entrance of Death Valley Natl. Mon., *Mosquin* & *Lewis 3258–2*; east of Darwin, *Snow 26* (approximate count)[a]; just below Darwin Falls, *Raven 12114*. Kern County: 2 miles southeast of Searles Station, *Lewis* & *Mosquin 1117–4*. Los Angeles County: 0.5 mile north of Pearblossom, *Mosquin 3265*. Riverside County: about 5 miles west of road to Cottonwood Springs on United States Highway 60, *Lewis* & *Ernst* in 1949 (3 plants)[b]; road to Cottonwood Springs, 7.2 miles north of United States Highway 60, *Snow 10*[a]; Box Canyon, *Snow 51*[a]. San Bernardino County: 0.8 mile north of Atolia, *Lewis* in 1950[b]; about 2 miles west of Lucerne Valley, *Snow 12*[a]; 10.2 miles east of Barstow, *Snow 23*[a]; United States Highway 395, 22 miles south of Inyo County line, *Snow 25–1*[a]; 15.9 miles south of Kramer Junction, *Lewis* & *Mosquin 1114*; 2 miles north of Needles, *Raven 13891* (approximate count). San Diego County: Mason Valley, near Vallecito Station, *Ernst 258*[c]. Baja California, Mexico. 14.8 miles south of Mexican Highway 2 on road to San Felipe, *Raven 11630*.

Eschscholzia minutiflora also occurs in the South Coast Ranges of California (*Axelrod 260*, UC; *Axelrod 9170*, POM; *Schreiber 1045*, UC). The identification of this species is based on morphological considera-

[2] Counts by Snow (unpublished) indicated by [a], those of Lewis & Snow, by [b], those of Ernst, 1958, by [c], and those of Ernst, 1959, by [d]. Vouchers for chromosome number determinations not previously reported are on file in the herbarium, University of California, Berkeley, or in the herbarium, University of California, Los Angeles. The first set of my own collections are deposited at the herbarium of the University of California at Berkeley.

Table 1. Morphological Comparison of Three Species* of Eschscholzia

	E. parishii (n=6)	*E. covillei* (n=12)	*E. minutiflora* (n=18)
Habit (rosette)	Poorly developed	Well developed	Well developed (Colorado Desert) or lacking (Mohave Desert)
Habit (branching)	Slender, delicate	Much-branched	Much-branched
Length of longest petals (range in mm.)	8–22	7–18	4–10
Length of mature buds (range in mm.)	7–16	6–9	2–7
Bud apex	Acuminate	Acuminate	Blunt (Colorado Desert or acuminate (Mohave Desert)
Number of stamens (range)	16–37	8–15	4–15
Length of longest stamens (range in mm.)	4–7.5	3.5–5	2–4
Number of pollen grooves** (range of means)	5.5–7	7.5–9.1	8.2–10.4
Diameter of pollen (range in microns)	20–32	24–37	25–44

* Only considering plants from which the chromosome number has been determined, 9 of *E. parishii*, 12 of *E. covillei*, and 27 of *E. minutiflora*.

** Mean of each plant based on 10 grains.

tions. One plant (*Axelrod 9170*) which was examined in detail had only 10 stamens per bud, a pollen diameter of 40 to 44 microns and usually 11 rarely 10 grooves per pollen grain. I have examined the pollen of the diploids *E. californica* Cham., *E. caespitosa* Benth., *E. glyptosperma* Greene, and *E. californica* var. *peninsularis* (Greene) Munz, and have found these plants to have a pollen variation comparable to *E. parishii* and out of the range of the pollen of *E. minutiflora*. A comparison of the pollen traits of *E. minutiflora* in the South Coast Range to those of *E. parishii* as shown in table 1 can leave little doubt that these Coast Range plants are hexaploid. The presence of this desert hexaploid in dry areas of the South Coast Ranges is not too surprising for a similar pattern of distribution is known for other desert annuals, e.g. *Linanthus parryae* (Gray) Greene, *Streptanthella longirostris* (Wats.) Rydb., *Erio-*

gonum trichopes Torr., *Chaenactis xantiana* Gray and *Salvia columbariae* Benth.

Department of Botany,
University of California, Los Angeles

Literature Cited

Abrams, L. R. 1944. Illustrated flora of the Pacific States. Vol II. Stanford.
Ernst, W. R. 1958. Chromosome numbers of some western Papaveraceae. Contr. Dudley Herb. 5:109–115.
———. 1959. Chromosome numbers of some Papaveraceae. Contr. Dudley Herb. 5:137–139.
Jepson, W. L. 1922. A flora of California, Vol. I. Berkeley.
———. 1925. Manual of the flowering plants of California. Berkeley.
Lewis, H., and R. Snow. 1951. A cytotaxonomic approach to Eschscholtzia. Madroño 9:141–143.
Munz, P. A. 1935. Manual of southern California botany. Claremont, Calif.
———. 1959. A California flora. Berkeley.

ABNORMAL FRUITS AND SEEDS IN ARCEUTHOBIUM[1]

Frank G. Hawksworth

The normal *Arceuthobium* fruit, as described in the literature (Thoday and Johnson 1930, Dowding 1931, Gill 1935, Kuijt 1955, 1960), consists of a single seed containing one embryo. This paper describes abnormal fruits with two seeds and seeds with two embryos and endosperms as found in some specimens of *A. americanum* Nutt. ex Engelm. and *A. vaginatum* f. *cryptopodum* (Engelm.) Gill.

The fruit of *Arceuthobium* and other members of the Loranthaceae differs from other angiosperms in that there are no true ovules. The ovarian cavity becomes nearly filled by an undifferentiated mound of tissue termed the mamelon, nipple, or ovarian papilla. Two embryo sacs are borne within the ovarian papilla. Usually only one embryo sac develops, but occasional diembryonic seeds have been reported in a number of species (Peirce 1905, Weir 1914, and Heinricher 1915). The process of fertilization in *Arceuthobium* has not been precisely described. However, the development of the embryo sac after fertilization is apparently similar to that in most dicotyledonous plants. As the fruit matures, the dominant embryo sac develops into a copious endosperm with a small embryo. The remnants of the ovarian papilla become crushed, and in *A. pusillum* they form a distinct "crest" at the base of the seed (Thoday and Johnson 1930). The crest was not well defined in the mature, normal *A. americanum* (fig. 1A) and *A. vaginatum* f. *cryptopodum* fruits examined. However, a small mass of tissue which is presumed to be analogous to the

[1] Acknowledgment is expressed to Job Kuijt, Department of Biology and Botany, University of British Columbia, for reviewing the manuscript and to William Schacht, School of Forestry, Duke University, for providing some of the abnormal fruits described.

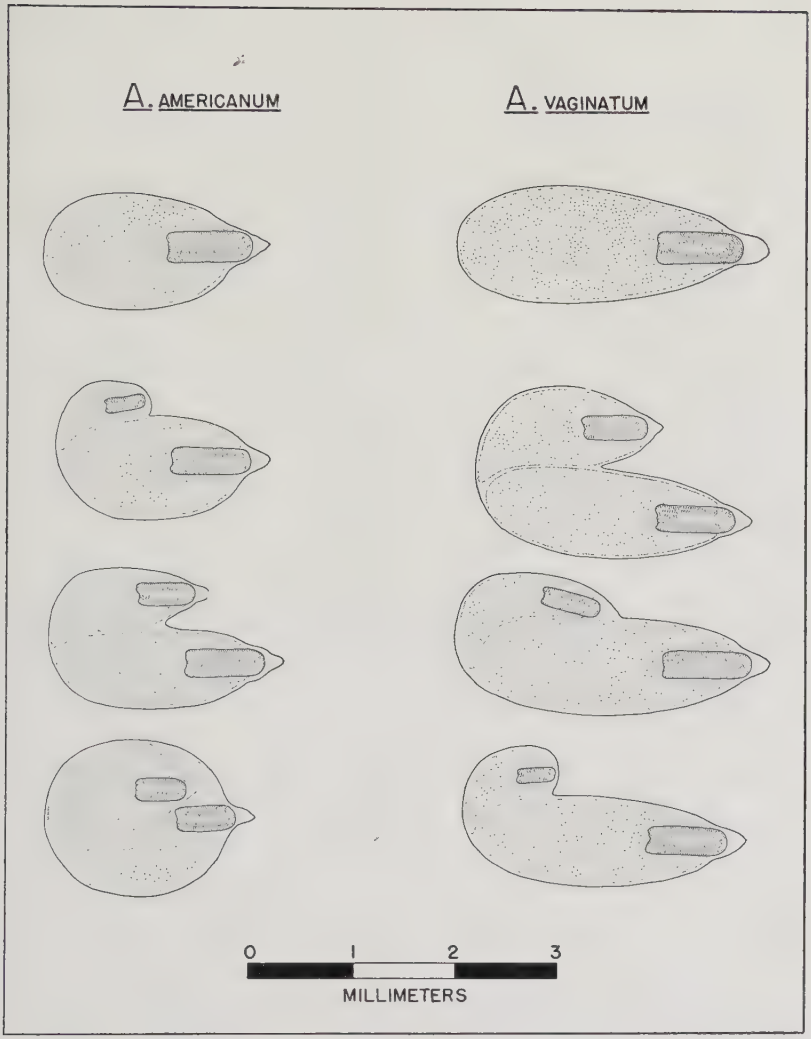


FIG. 1. Semi-diagrammatic drawings of longitudinal sections through *Arceuthobium americanum* fruits. A. Normal fruit with a single seed containing one embryo. The tissues labeled are: *v.c.*, viscin cells; *per.*, pericarp; *e.*, endocarp of the seed; *emb.*, embryo; *end.*, endosperm; *a.l.*, abscission layer; and *ped.*, pedicel. B-F. Abnormal fruits; these are described in the text.

crest in *A. pusillum* was observed in most fruits. At maturity the *Arceuthobium* fruit is severed from its pedicel, and the seed is forcibly ejected.

ABNORMAL FRUITS

Fruits of *A. americanum* with more than one stigma (figs. 1, 2) were noticed from plants in several areas of the Medicine Bow National Forest

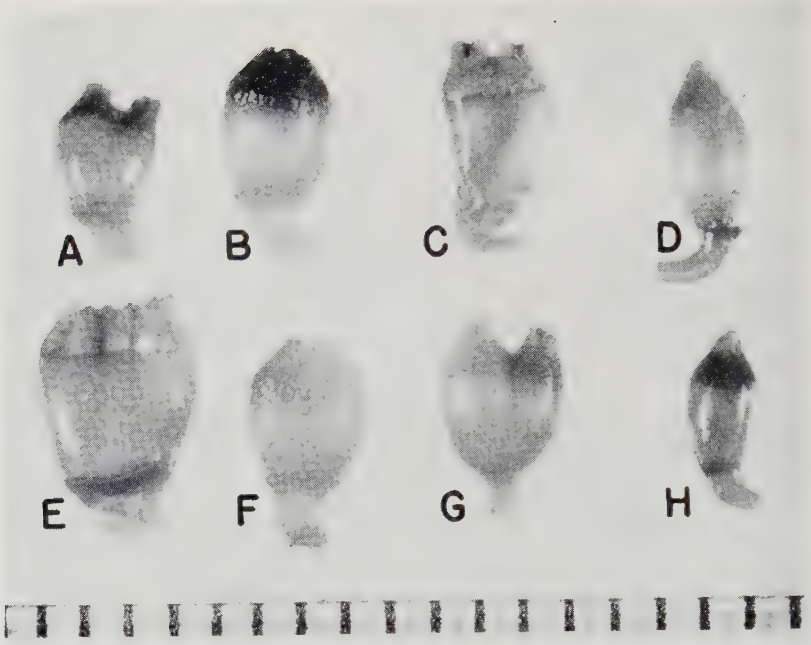


Fig. 2. Fruits of *Arceuthobium americanum*: normal, D and H; abnormal, A-C, E-G. Scale below is millimeter rule.

in southern Wyoming and the Roosevelt National Forest in northern Colorado. In a sample of 803 fruits from one locality in the latter forest, seven, or 0.9 per cent, had two stigmas. Dissection of 16 abnormal fruits collected in August revealed four general types.

Type 1. Fruits with two stigmas and two normal seeds (fig. 1B; fig. 2F and 2G). A wall of tissue separating the two seeds was sometimes present (fig. 1F) and sometimes not (fig. 1B). Nine of the sixteen fruits dissected were of this type.

Type 2. Fruits with two stigmas, one normal seed and one aborted seed (fig. 1C and 1D; fig. 2A and 2C). Four specimens had a small aborted seed (fig. 1C), but only one was found with two full-sized chambers (fig. 1D).

Type 3. Fruit with one stigma but two normal seeds (fig. 1E; fig 2B). Only one such fruit was found.

Type 4. Fruit with three stigmas and two normal seeds (fig. 1F; fig. 2E). One of the seeds had two embryos. Only one fruit of this type was found.

The abnormal fruits averaged about the same length as normal ones (3.6 mm.) but were about 50 per cent wider (2.7 compared with 1.9 mm.). The seeds from the multiple fruits measured 0.9 x 2.1 mm. compared with 1.0 x 2.2 mm. for seeds from normal fruits on the same plants.

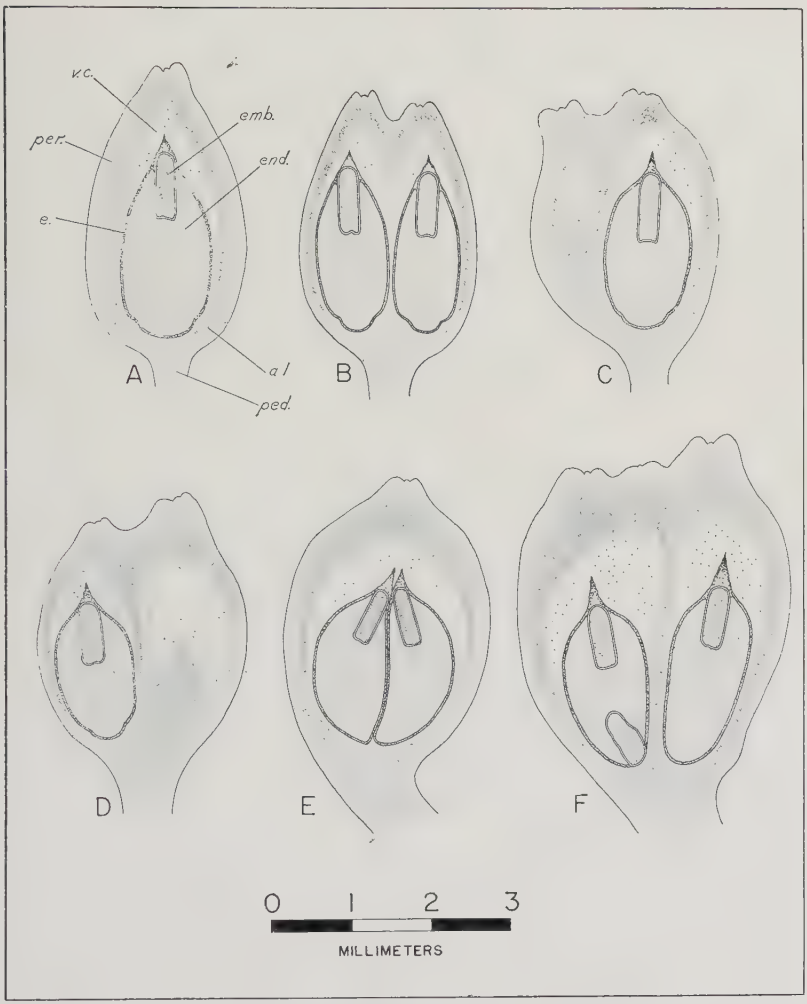


Fig. 3. Seeds of *Arceuthobium americanum* and *A. vaginatum* f. *cryptopodum*. The upper seed in each column is normal and of average size for the species. The lower three seeds in each column represent abnormal forms with two elements, each with an endosperm (light stippling) and embryo (dark stippling) within a common endocarp.

Intensive search yielded only one fruit of *A. vaginatum* f. *cryptopodum* with more than one stigma. This fruit, from near Estes Park, Colorado, had three stigmas and three distinct chambers. Two of these, the outer ones, contained normal seeds, but the central chamber had an apparently aborted seed (similar to that in the right chamber in fig. 1D).

Fruits with multiple stigmas have not been reported previously in *Arceuthobium*. Unfortunately, there has been no opportunity to observe

the development of these abnormal fruits. Possibly the double fruits arise as fasciations and each stigma is pollinated separately. The resulting seeds seem to develop more or less independently of each other. The two seeds are enclosed in separate endocarps.

Usually both seeds develop at about the same rate (type 1, fig. 1B), but sometimes one is suppressed (type 2, figs. 1C and 1D). I am unable to explain satisfactorily the development of the fruit bearing a single stigma but containing two normal seeds (type 3, fig. 1E); however, both embryo sacs may have developed as each seed became enclosed in a separate endocarp. The most unusual fruit was that containing three stigmas and two seeds, one with two embryos (type 4, fig. 1F). The diembryonic seed had embryos at opposite ends. Both embryos were about normal size, but the accessory one was somewhat irregular in shape.

Abnormal Seeds

Peirce (1905) described a seed of *A. campylopodum* f. *campylopodum (A. occidentale)* that had two embryos (one about normal size and the other one third normal size) but within a single endosperm. Weir (1914) reported diembryonic seeds in *A. vaginatum* f. *cryptopodum* (3 of 20 seeds), *A. douglasii* (4 of 30 seeds), and *A. americanum*, and although he did not describe them in detail, he stated that they were morphologically similar to normal seeds but "occasionally below average size." Heinricher (1915, Plate 1, fig. 6) illustrated an unusual diembryonic seed in the European *A. oxycedri*; the seed itself appears to be similar to normal seeds, but it has two hypocotyls.

Diembryonic seeds have been found by the writer in both *A. americanum* and *A. vaginatum* f. *cryptopodum*. They differ from the diembryonic seeds previously described in the literature (see above) in that they also contain two endosperms (fig. 3). Apparently both embryo sacs develop so that there are two units each of embryo and endosperm, both enclosed within a common endocarp. (These differ from the seeds shown in fig. 1E which are enclosed in separate endocarps.) The two units differ in size, the embryo in the larger unit being about normal size. The embryo in the second unit is smaller, the reduction being approximately proportional to that of the endosperm. No seeds of this type were found in the abnormal fruits dissected, therefore it is assumed that they are formed in normal appearing fruits.

Counts of *Arceuthobium vaginatum* f. *cryptopodum* seeds in various localities showed that 1.0 per cent were of this abnormal type (Table 1).

No counts have been made on the frequency of abnormal seeds in *A. americanum*, but they appear to be about as rare as in *A. vaginatum* f. *cryptopodum*. It has not been determined whether or not these abnormal seeds will produce two hypocotyls. However, Heinricher (1915) and Weir (1914) observed formations of double hypocotyls in the species of *Arceuthobium* which they studied.

Table 1. Abnormal Seeds of Arceuthobium vaginatum f. cryptopodum from Various Localities.

Locality	Seeds examined Number	Abnormal Percent
Sandia Mountains, New Mexico	500	2.4
Manzano Mountains, New Mexico	925	1.7
Flagstaff, Arizona	3,950	0.8
Roosevelt National Forest, Colorado	772	0.7
Totals	6,147	1.0

Discussion

The formation of two seeds in the fruit of *Arceuthobium* has the advantage of increased reproductive capacity. However, this is presumably accompanied by decreased efficiency of the seed dispersal mechanism.

Polyembryony is common in the Loranthaceae. Its possible significance in the dioecious mistletoes is discussed by Allard (1943). He suggests that male and female plants may arise from different embryos within a seed. If this is true, it is possible that a mistletoe population could develop in a new area from a single seed.

Rocky Mountain Forest and Range Experiment Station,
Forest Service, U.S. Department of Agriculture,
with headquarters at Colorado State University,
Fort Collins, Colorado

Literature Cited

Allard, H. A. 1943. The eastern false mistletoe (Phoradendron flavescens); when does it flower? Castanea 8:72–78.

Dowding, E. Silver. 1931. Floral morphology of Arceuthobium americanum. Bot. Gaz. 91:42–54.

Gill, L. S. 1935. Arceuthobium in the United States. Trans. Conn. Acad. Arts and Sci. 32:111–245.

Heinricher, E. 1915. Die Keimung und Entwicklungsgeschichte der Wacholdermistel, Arceuthobium oxycedri, auf Grund durchgeführter Kulturen geschildert. Akad. Wien. Sitz-ber. 124:319–352.

Kuijt, Job. 1955. Dwarf mistletoes. Bot. Rev. 21:569–626.

————. 1960. Morphological aspects of parasitism in the dwarf mistletoes (Arceuthobium). Univ. Calif. Publ. Bot. 30(5):337–436.

Peirce, George J. 1905. The dissemination and germination of Arceuthobium occidentale, Eng. Ann. Bot. 19:99–113.

Thoday, D. and Johnson, Emma Trevor. 1930. On Arceuthobium pusillum, Peck. II. Flowers and Fruit. Ann. Bot. 44:813–824.

Weir, J. R. 1914. The polyembryony of Razoumofskya species. Phytopathology 4:385–386.

TO ALBERT W. C. T. HERRE

Dr. Herre, the California Botanical Society congratulates you on your forthcoming ninety-third birthday, September 16, 1961. This close approach to the century mark in itself excites admiration among us, for few indeed possess the heritage that makes such an accomplishment possible. But attainment of this outstanding age is but one of the attributes that places you high in our esteem, for your accomplishments as a naturalist in the fields of ichthyology, lichenology, and ecology through three quarters of a century set you apart as a scientist extraordinary.

As we realize that lichenology has claimed only a segment of your thought, study, and publishing activities, and that your list of papers dealing with taxonomic ichthyology, ecology, and geographical distribution of fishes includes several hundred titles, we marvel that one man has been able to accomplish so much in his life-time, long and busy though it has been. Nor, we realize, has writing scientific papers, monographs, and textbooks claimed all of your time and energy. Individuals well beyond middle age can recall that their early grade and high school training occurred under your supervision while you served as teacher, principal, and superintendent of schools. Others are equally aware of your administrative and research activities in the Philippines and your promotion of careful work on fishes and other natural resources in that part of the world before you returned to the United States in 1928.

We remember, also, that you accepted a challenging appointment with the Fish and Wildlife Service after you became Curator Emeritus of the Ichthyological Collections at Stanford University in 1947, and spent a strenuous year in your old area of field operations, the Philippine Islands, carrying on extensive collecting activities.

Adding further to your laurels, you followed the Philippine work with a dozen years as Ichthyologist and Curator of Tropical Fishes at the University of Washington, carrying forward work on large collections of lichens during your "spare" time. Then, when Mrs. Herre's health was jeopardized by the cool, damp climate along the Washington coast, and you moved to Santa Cruz, some thought you would be content to reduce your work load and withdraw from active participation in biological research. Others, who knew better your penchant for continuous work, were not greatly surprised that instead, you launched into the final stages of preparing a monograph on the genus *Usnea* as represented in North America. Few, indeed, have the strength, the desire, and the will to take up such an arduous task when nearly ninety years of age. Still fewer successfully apply to the National Science Foundation for a grant to enable them to visit over a score of herbaria and private collections to carry the undertaking to completion!

In celebration of your ninety-third birthday, we congratulate you on your scientific accomplishments, admire your physical stamina and mental alertness, wish we could consistently display your cheerfulness,

Dr. Albert W. Herre
on his 85th birthday, Sept. 16, 1957

and hope that one of us may have the privilege of preparing a congratulatory message to you seven years hence. We sincerely hope that you will enjoy yet more years of extraordinary good health and continue your interest in the various phases of natural history that have fascinated you and to which you have contributed so much during a large portion of a century.—Ira L. Wiggins, Stanford University.

CHROMOSOME COUNTS IN THE GENUS MIMULUS (SCROPHULARIACAE)

Barid B. Mukherjee and Robert K. Vickery, Jr.

Although our long range investigation concerns the evolution of species in sections *Simiolus* and *Erythranthe* of the genus *Mimulus* (Vickery, 1951), we have recently made genetical and cytological studies of several species belonging to other sections of the genus. The crossing results have already been given (Vickery, 1956), and this paper presents the cytological findings.

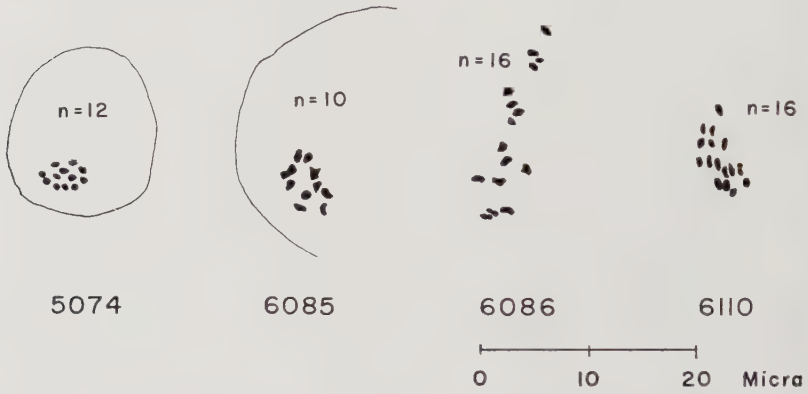


Fig. 1. Meiotic chromosomes of *Mimulus ringens* (5074), *M. aurantiacus* (6085), *M. moschatus* (6086) and *M. floribundus* (6110). All configurations are in or near second metaphase. Camera lucida drawings were made at ×2,520 and reduced to ×1,260 in reproduction.

The same method of bud fixation was employed as in previous investigations (Mukherjee and Vickery, 1959, 1960). Each chromosome number determination was based on counts from an average of nine pollen mother cells. Herbarium specimens of each culture will be deposited in the Garret Herbarium of the University of Utah (UT).

Four species, representing three sections of the genus, were studied: *Mimulus ringens* L. of section *Eumimulus*; *M. aurantiacus* Curt. of section *Diplacus*; and *M. moschatus* Dougl. and *M. floribundus* Dougl., both of section *Paradanthus* (see table 1 and figure 1).

The count of n = 12 for blue flowered *M. ringens* of eastern North America, type species of the genus, differs from any previously reported for the genus (Campbell, 1950; Carlquist, 1953; Darlington and Wylie, 1955; McMinn, 1951; Mukherjee and Vickery, 1959, 1960; Mukherjee, Wiens, and Vickery, 1957a, 1957b; and Vickery, 1955). However, *M. ringens* is the only species so far counted in section *Eumimulus*, and additional counts of n = 12 are possible in this section.

Shrubby *M. aurantiacus* of the chaparral areas of central and northern California was found to have n = 10 chromosomes, as do other

Table 1. Chromosome Counts in the Genus Mimulus.

n = 12	*M. ringens* L., section *Eumimulus*. St.-Jean, St.-Jean County, Province of Quebec, altitude ca. 200 feet, *M. Raymond* and *J. Kucyniak*, summer 1951 (5074).
n = 10	*M. aurantiacus* Curt., section *Diplacus*. Near Round Top, Alameda County, California, altitude 1,200 feet, *Vickery 990* (6085).
n = 16	*M. moschatus* Dougl., section *Paradanthus*. Mill Creek Canyon, Salt Lake County, Utah, altitude 7,400 feet, *Vickery 1036* (6086).
n = 16	*M. floribundus* Dougl., section *Paradanthus*. Hog Ranch, Mather, Tuolumne County, California, altitude 4,600 feet, *Vickery 1372* (6110).

species of section *Diplacus* previously reported by McMinn (1951). McMinn's extensive crossing studies suggest that this number, not found in other sections of the genus, is characteristic of section *Diplacus*.

Mimulus moschatus and *M. floribundus*, both widespread in western North America, were found to have n = 16 chromosomes. Both species have small yellow flowers and are low-growing with viscid-pubescent leaves and stems, but they differ markedly in leaf size and shape and in duration (*M. floribundus* is annual; *M. moschatus* is perennial). The two species hybridized readily in the garden. The F_1 hybrids were vigorous, but completely sterile (Vickery, 1956). Despite the cytological and some morphological similarities, these two entities would appear to be genetically and taxonomically distinct.

Department of Genetics and Cytology
University of Utah
Salt Lake City 12, Utah

Literature Cited

Campbell, G. R. 1950. Mimulus guttatus and related species. El Aliso 2:319–335.
Carlquist, S. 1953. *in* Documented chromosome numbers of plants. Madroño 12:31.
Darlington, C. D. and A. P. Wylie. 1955. Chromosome atlas of flowering plants. Allen and Unwin Ltd. London. 519 pp.
McMinn, H. E. 1951. Studies in the genus Diplacus (Scrophulariaceae). Madroño 11:33–128.
Mukherjee, B. B. and R. K. Vickery, Jr. 1959. Chromosome counts in the section Simiolus of the genus Mimulus (Scrophulariaceae). III. Madroño 15:57–62.
———. 1960. Chromosome counts in the section Simiolus of the genus Mimulus (Scrophulariaceae). IV. Madroño 15:239–245.
Mukherjee, B. B., D. Wiens, and R. K. Vickery, Jr. 1957a. Chromosome counts in the section Simiolus of the genus Mimulus (Scrophulariaceae). II. Madroño 14:128–131.
———. 1957b. Chromosome counts in the section Erythranthe of the genus Mimulus (Scrophulariaceae). Madroño 14:150–153.
Vickery, R. K., Jr. 1951. Genetic differences between races and species of Mimulus. Carn. Inst. Wash. Year Book 50:118–119.
———. 1955. Chromosome counts in section Simiolus of the genus Mimulus (Scrophulariaceae). Madroño 13:107–110.
———. 1956. Data on intersectional hybridizations in the genus Mimulus (Scrophulariaceae). Proc. Utah Acad. 32:65–71.

SPHENOPHYLLUM NYMANENSIS SP. NOV. FROM THE UPPER PENNSYLVANIAN[1]

J. F. Davidson

While coal is not found in commercial quantities in Nebraska, there are a number of thin seams exposed in the southeastern counties of the state, and investigation of these has proved to be quite profitable from a paleo-botanical viewpoint. In the majority of sites investigated, a layer of limestone immediately above the coal has precluded the finding of anything but highly coalified fossils. However, in the clay pit of the Western Brick Company at Nebraska City in Otoe County, the exposed Nyman coal shales out, and plant fossils are abundant. Plant material is so abundant in fact that the specimens, frequently with cuticle intact, are almost impossible to separate. It was from this site that representatives of the Pennsylvanian Sphenopsida of the order Sphenophyllales, including the present *Sphenophyllum*, were collected.

According to Condra and Reed (1943), the Nyman coal is found toward the top of the Langdon shale formation of the Richardson Subgroup, Wabaunsee Group, Virgil Series of the Pennsylvanian Sub-system. In part of the clay pit, as in the other sites mentioned above, the Nyman coal lies immediately below the Dover limestone. As the coal begins to shale out, the plant remains are separated by such minute quantities of shale as to be almost impossible to recover. However, as shaling continues, and the amount of shale increases, the plant remains are more readily defined. Preservation is very good in the fine sediment, and, as reported by Barbour (1914), many compressions retain their cuticular coverings which may be floated free, cleared, and mounted for study.

In the deposit, specimens of *Sphenophyllum* are fairly common, although few show more than two or three nodes. *Sphenophyllum cuneifolium* Sternb., *S. emarginatum* Brong. and *S. majus* Brong. are represented, as well as another large-leaved taxon which was at first considered to be a variant of *S. majus*. Closer examination, and a comparison of a number of these large-leaved specimens with specimens of *S. majus* indicate that two taxa are involved, and the name *Sphenophyllum nymanensis* is hereby proposed for the novelty.

Sphenophyllum nymanensis sp. nov. (Fig. 1) Leaves in whorls of 6 per node, 12–17 mm. long, 5–10 mm. wide; veins branching 3–5 times from the base, terminating at the rounded to somewhat truncate apex; stems fairly robust for a *Sphenophyllum*, about 2 mm. in diameter, with nodes swollen to 3 mm.; internodes subequalling the leaf length, 12–17 mm. long.

Locality. Clay pit, Western Brick Company, Nebraska City, Otoe County, Nebraska.

[1] This work was supported by a grant from the University of Nebraska Research Council.

HORIZON. Nyman coal, and Langdon shale above, Virgil Series, Upper Pennsylvanian.

TYPE. Paleobotanical collection, University of Nebraska State Museum.

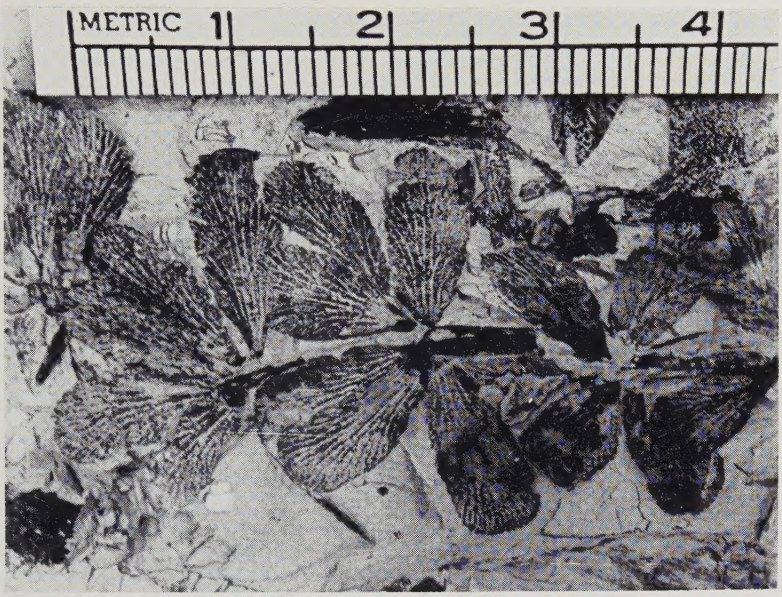


FIG. 1. *Sphenophyllum nymanensis* J. F. Davidson.

Sphenopyllum nymanensis, in terms of size most closely resembles *S. majus* from which it is readily distinguished by the following characters:

S. nymanensis	*S. majus*
6 leaves per node	8–10 leaves per node
leaf apex rounded to slightly truncate	leaf apex truncate
leaf margin entire	leaf margin with each vein terminating in a small deltoid tooth.

Department of Botany,
University of Nebraska,
Lincoln, Nebraska.

LITERATURE CITED

BARBOUR, E. H. 1914. Plant tissue in the Carboniferous shales of Nebraska. Nebr. Geol. Surv. 4, part 16, pp. 231–232.

CONDRA, G. E. and E. C. REED. 1943. The geological section of Nebraska. Nebr. Geol. Surv. Bull. 14.

A NEW NAME IN THE ALGAL GENUS PHORMIDIUM

FRANCIS DROUET

Phormidium anabaenoides, nom. nov. *P. thermale* Drouet. Publ. Field Mus. Bot. 20(6):138. 1942. A new name is necessary for this alga of hot springs of Lake and Sonoma counties, California, because of the discovery in the literature of another *P. thermale* described by Professor V. Vouk (Prirod. Istr. Hrvatske i Slavon., Jugosl. Akad., Mat.-Prirod. Razr. 8:9. 1916). The research involved here was supported by the National Science Foundation.

Department of Botany, College of Agriculture
University of Arizona, Tucson

NOTES AND NEWS

PLAGIOBOTHRYS AUSTINAE (GREENE) JOHNSTON: A NEW ADDITION TO THE OREGON FLORA.—In April, 1959, the distinctive *Plagiobothrys austinae* (Greene) Johnston, formerly believed endemic to the Great Valley of California with a range of distribution from Stanislaus to Shasta counties, was collected in the botanically interesting Agate Desert west of Camp White, Jackson County, Oregon (*Ornduff 5043A*, UC, OSC, WTU). The locality in Oregon where this species occurs is separated from its nearest station in California near Redding, Shasta County, by about 140 miles of the Klamath-Cascade mountain complex. In many aspects of vegetation and topography, the Agate Desert is strongly reminiscent of parts of the northern Sacramento Valley in California; consequently, intensive collecting in the future may be expected to reveal additional Californian floral elements in the Agate Desert.—FRANCIA CHISAKI and ROBERT ORNDUFF, Department of Botany, University of California, Berkeley.

STEGNOSPERMA CUBENSE AND GOSSYPIUM KLOTZSCHIANUM DAVIDSONII NOT KNOWN IN THE REVILLAGIGEDOS.—On the expedition of the California Academy of Sciences to the Revillagigedo Islands in 1925, plant collections were made not only there but also en route (Proc. Calif. Acad. ser. 4, 18:393–484, 1929). Labels of way specimens, headed "Expedition to the Revillagigedo Islands," have led evidently to one and apparently to two erroneous reports.

Rogers (Ann. Missouri Bot. Gard. 36:476, 1949) reported *Stegnosperma cubense* A. Richard from the Revillagigedos on the basis of *Mason 1846*; but Mason's fieldbook shows that this collection is from Isabel Island, just off the Mexican mainland.

Hutchinson (in Hutchinson, Silow, and Stephens, The evolution of *Gossypium* and the differentiation of the cultivated cottons, 1947, p. 23) reported *Gossypium klotzschianum* var. *davidsonii* (Kellogg) Hutchinson from the Revillagigedos, though without citing a specimen. This report has been repeated elsewhere. Upon inquiry, Dr. Hutchinson wrote that the report appeared to be erroneous, based on a specimen from an expedition to the Revillagigedos but collected in Baja California. Very likely he was misled by the same label heading (*Mason 1936, 1937* from Magdalena Bay).

Since it does not seem feasible at present to square the facts with the reports by introducing these two plants into the Revillagigedos, perhaps the best expedient is this note.—REID MORAN, Natural History Museum, San Diego, California.

INFORMATION FOR CONTRIBUTORS

Manuscripts submitted for publication should not exceed an estimated 20 pages when printed unless the author agree to bear the cost of the additional pages at the rate of $20 per page. Illustrative materials (including "typographically difficult" matter) in excess of 30 per cent for papers up to 10 pages and 20 per cent for longer papers are chargeable to the author. Subject to the approval of the Editorial Board, manuscripts may be published ahead of schedule, as additional pages to an issue, provided the author assume the complete cost of publication.

Shorter items, such as range extensions and other biological notes, will be published in condensed form with a suitable title under the general heading, "Notes and News."

Institutional abbreviations in specimen citations should follow Lanjouw and Stafleu's list (Index Herbariorum. Part 1. The Herbaria of the World. Utrecht. Second Edition, 1954).

Articles may be submitted to any member of the Editorial Board.

Membership in the California Botanical Society is normally considered a requisite for publication in MADROÑO.

MADROÑO

A WEST AMERICAN JOURNAL OF BOTANY

A quarterly journal devoted to the publication of botanical research, observation, and history. Back volumes may be obtained from the Secretary at the following rates:

Volume I, 1916–1929	$5.00
Volume II, 1930–1934	5.00
Volume III, 1935–1936	5.00
Volume IV, 1937–1938	5.00
Volume V, 1939–1940	5.00
Volume VI, 1941–1942	5.00
Volume VII, 1943–1944	5.00
Volume VIII, 1945–1946	5.00
Volume IX, 1947–1948	6.00
Volume X, 1949–1950	7.00
Volume XI, 1951–1952	8.00
Volume XII, 1953–1954	8.00
Volume XIII, 1955–1956	8.00
Volume XIV, 1957–1958	8.00
Volume XV, 1959–1960	10.00

The subscription price of MADROÑO is $6.00 per year. If your institution does not now subscribe to MADROÑO, we would be grateful if you would make the necessary request. Since there is no extra charge for institutional subscriptions, an individual may hold membership in the California Botanical Society on the basis of his institution's subscription.